LAKE SERENE 2005 2,4-D TREATMENT – MONITORING RESULTS

Background

Lake Serene is an important recreational and residential lake in southwestern Snohomish County. The 43-acre lake is located within a dense urban/suburban area near the cities of Lynnwood and Mukilteo. The entire lake shoreline and most of the 223-acre watershed are developed with single family residences.

Lake Serene is shallow and rarely stratifies, having a mean depth of only 14 feet. This shallow depth, combined with very clear water (average Secchi depth of 5.2 meters since 1998) and rich bottom sediments, makes the lake an ideal environment for growing aquatic plants.

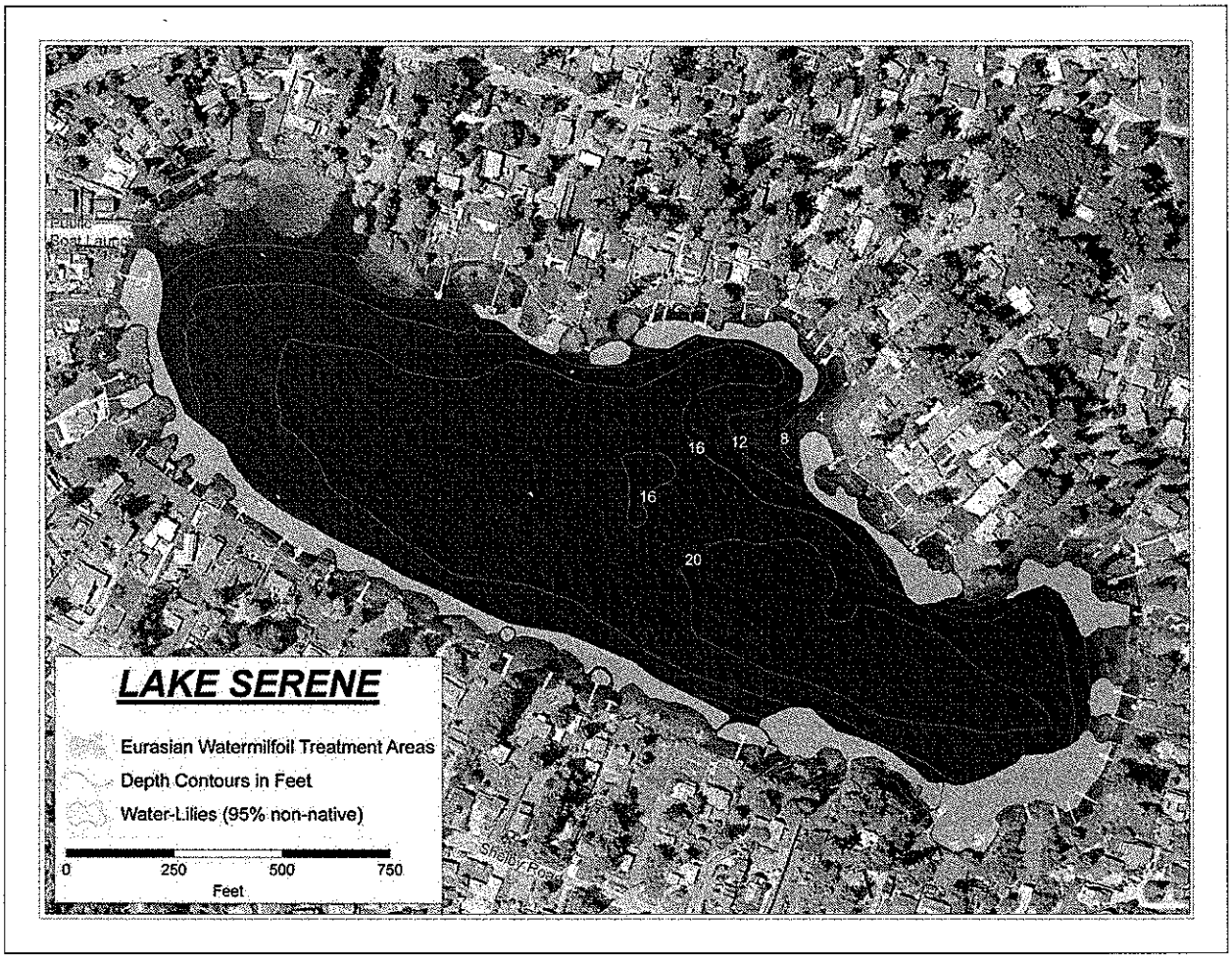
Eurasian watermilfoil (*Myriophyllum spicatum* L.) was discovered in Lake Serene in late August 2004 by staff of the Snohomish County Surface Water Management Division (SWM). County staff worked with lake residents to develop a plan of action to address the milfoil infestation and to secure an Early Infestation grant from the Washington Department of Ecology's Aquatic Weeds Management program prior to the 2005 growing season. Results of a diving survey in May 2005 revealed approximately one acre of dense Eurasian watermilfoil beds and about five more acres of scattered milfoil plants spread around the lake shoreline.

Herbicide Treatment

The plan developed by SWM and lake residents called for spot treatments of infested areas of Lake Serene using the liquid formulation of 2,4-D in early summer to be followed by hand removal and spot treatments of remaining areas using triclopyr in late summer. The County hired a licensed applicator (AquaTechnex) to perform the herbicide treatments.

AquaTechnex treated 6.0 acres of Lake Serene with liquid 2,4-D (DMA*4IVM™) on June 29, 2005. Treatment areas are shown on Map 1. The herbicide was applied using sub-surface injection. A total of 127 gallons of herbicide was used, which translates to a rate of about 2.5 ppm in the treatment areas.

MAP 1. MILFOIL TREATMENT AREAS



Herbicide Residue Sampling

County SWM staff collected water samples for herbicide residue testing one day before treatment, 24 hours after treatment, 6 days after treatment, and 30 days after treatment. Samples were taken at two locations inside the treatment areas (at the east and west ends of the lake) and at one station in the middle of the lake outside the treatment areas. The pre-treatment sampling was done only at the mid-lake station. Map 2 shows the location of the sampling stations and treatment areas.

All water samples were taken at a discrete depth of one and one-half meters deep at each station using a Van Dorn-style water sampler. Samples were collected in amber glass containers, kept chilled and in the dark, and delivered to Edge Analytical laboratory in Burlington, Washington (an Ecology-accredited lab). Duplicates of every sample were collected for laboratory quality control purposes. The laboratory analyzed the samples according to EPA method 515.1.

2,4-D RESIDUE MONITORING RESULTS			
Time of Sampling	West (inside treatment area	East (inside treatment area	Mid-lake (outside treatment areas)
Pre-treatment	----	----	1.15 ppb
24 hours after treatment	321 ppb	402 ppb	402 ppb
6 days after treatment	316 ppb	326 ppb	376 ppb
30 days after treatment	161 ppb	178 ppb	189 ppb
Target concentration in treatment areas was 2,500 ppb.			

Efficacy of Treatment

SWM conducted a diving survey of the entire littoral zone on August 8, 2005 (40 days after treatment). Results of the survey showed that most of the milfoil in the lake had been killed by the herbicide. In addition, the divers and SWM staff performed a quantitative survey of Eurasian watermilfoil root crowns and stems along six transects. This survey identified approximately 98% fewer milfoil plants than found along the same transects in a pre-treatment survey conducted in May.

However, the divers did find several hundred Eurasian watermilfoil plants with no leaves but standing stalks and intact root crowns in scattered locations within the treatment areas. A few of these plants still had some green along the lower portions of the stems. It was unclear if these plants might re-sprout as the herbicide dissipated. The divers hand-pulled as many standing plants as possible.

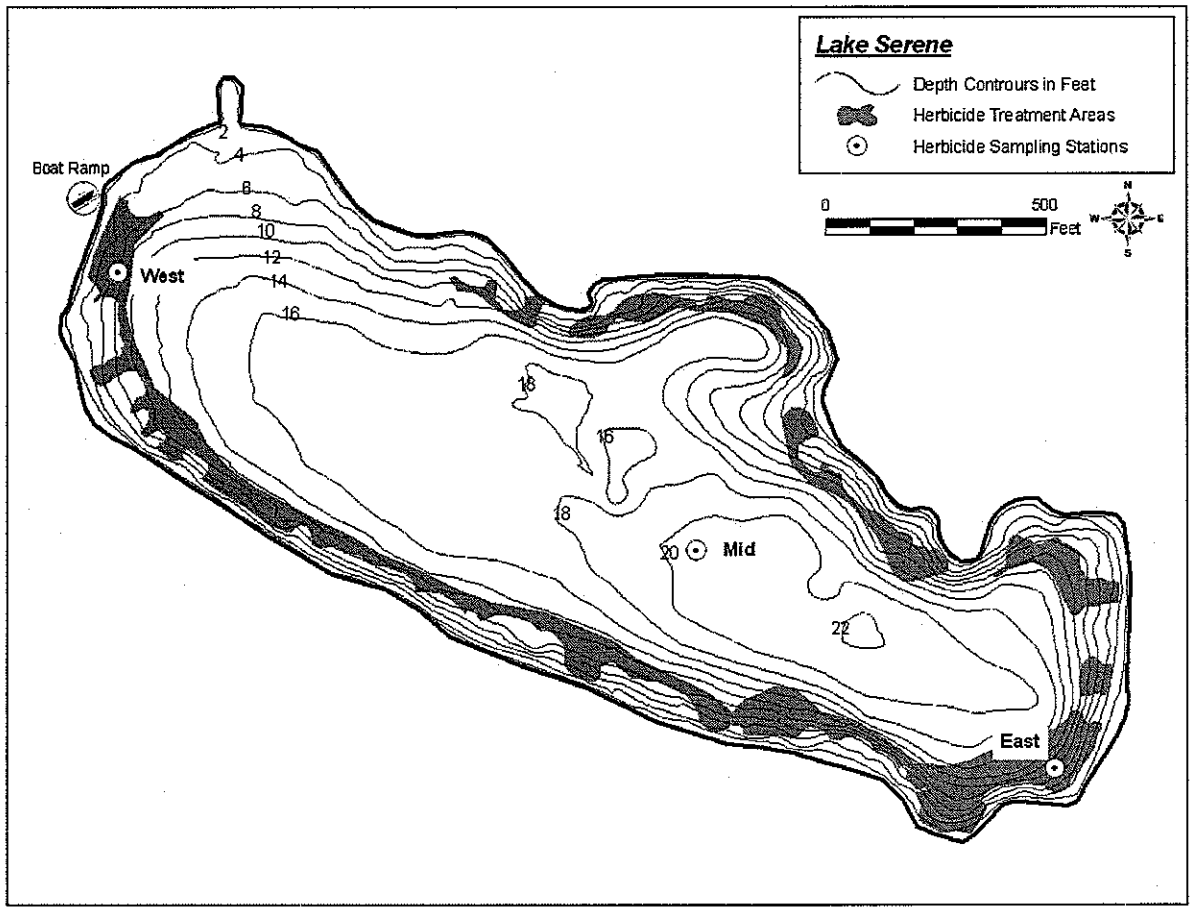
SWM removed several of the dead-looking, but still standing, milfoil plants and planted them in clean water in aquaria to watch for re-growth. Within two weeks, all the plants in the aquaria were sprouting new leaves.

SWM conducted a second diving survey to check for milfoil re-growth on August 26th (58 days after treatment). The divers found that even more of the milfoil plants had died. However, some of the plants with standing dead-looking stems had new leaves re-growing from the stems. The divers then hand-pulled as many of these re-sprouting plants as they could find.

One potential adverse impact of the herbicide treatment was observed in the lake. By late summer, there were thick clouds of filamentous algae growing over native plants and rising up to the surface in many locations. However, the algae clouds were not continuous around the lake, and there were few complaints from lake residents. There was no evidence of other water quality problems or fish kills in the lake. Algae blooms were not a concern, with post-treatment chlorophyll *a* values ranging from 1.3 to 2.4 ug/l. Water clarity averaged 5.4 meters—slightly better than the long-term average.

A follow-up herbicide treatment (using triclopyr) had been scheduled for late August. However, the 2,4-D treatment was so successful that there was not enough plant growth to effectively take up more herbicide. Therefore, the decision was made to delay the triclopyr treatment until 2006 when more re-growth is expected.

MAP 2. HERBICIDE SAMPLING STATIONS AND TREATMENT AREAS



The laboratory results of the herbicide residue testing are shown in the table below. One main conclusion from the data is that the liquid 2,4-D formulation is highly mobile. Within 24 hours of treatment, the 2,4-D had spread from the treatment areas throughout the lake. Concentrations in the middle of the lake were the similar to those within the six acres that were treated. Because of this mobility, it is likely that the treatment areas were exposed to the applied concentration of 2.5 ppm for only a very short time. Instead of spot treatments, the use of liquid 2,4-D provided, in effect, a low-concentration whole lake treatment.

Another result of the monitoring showed that the herbicide concentrations declined slowly following treatment. Even at the end of 30 days, the concentrations of 2,4-D were around 50% of the 24-hour levels and continued to exceed the EPA drinking water standard (70 ppb) and the irrigation water restriction (100 ppb). Fortunately, the lake is not a source of drinking water, and there were no reports of damage to irrigated lawns or gardens.